

REMARKS

The office action issued by the Examiner and the citations referred to in the office action have been carefully considered.

Amendment under 37 CFR 1.116

Inasmuch as the present case is finally rejected prior to the filing of an appeal, reconsideration of the above and amended claim presentation is requested as placing the claims in better form for consideration on appeal. Full reconsideration of the present claim set is kindly requested in light of the following remarks.

Objections to Claims

Claims 10, 30-31, 45-46, and 40-42 were objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.

By the above amendments, dependencies of claims 10, 45-46, and 40-42 have been corrected.

By the above amendments, claims 4, 11, 13, 30 and 31 are cancelled.

Rejections under 35 U.S.C. §112

Claims 1, 3-4, 8-18, 21-23, 25-31, 33-35, 37-38 & 47-49 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As a preliminary matter, no comments were presented in the Office Action with regard to claims 3-4, 10-18, 21-23, 25-26, 28, 34-35, 37-38 & 47-49 in the section discussing 35 U.S.C. 112, second paragraph rejections. Without further guidance or a *prima facie* case under 35 U.S.C. 112, second paragraph, Applicant cannot act with respect to these claims. Applicant requests that the Examiner contact the undersigned agent in the event that issues actually remain with respect to claims 3-4, 10-18, 21-23, 25-26, 28, 34-35, 37-38 & 47-49.

With respect to claim 1, its dependent claims, and whether the claimed language is requiring the composition to be deposited on the same surface that has had the surface treatment(s) performed thereon, claim 1 and various dependent claims have been amended from reciting “at least one surface” to simply recite “a surface.” It is believed that this clarifies that the operations recited in the claims relative to the surface refer to the same surface.

With respect to claim 27 and the partial pressure of oxygen, the Specification discloses:

The “window” for PdO formation and decomposition is also a function of the O₂ partial pressure (P_{O₂}). Less detailed information is available for atmospheres other than air; however, the temperature of PdO decomposition (more accurately, Pd--PdO equilibrium temperature) has been measured at a function of P_{O₂}. For air, this equilibrium temperature is approximately 800° C.; for P_{O₂}=10⁻² atm (as found in a normal N₂ cylinder) it is about 690° C.; and for P_{O₂}=10⁻⁵ atm (typical UHP N₂, it is about 500° C.) (S. F. Wang and W. Huebner, “Thermodynamic modeling of equilibrium subsolidus phase relation in the Ag--Pd--O₂ system”, J. Amer. Ceram. Soc. 74(6), 1349-1353 (1991)). [Specification, Paragraph [0060]].

Thus, exemplary implementations from the disclosure include operation at partial pressure of oxygen at 10⁻² atm and 10⁻⁵ atm. As such, it is respectfully submitted the amendment to claims 27 does not add new matter and is supported by the Specification.

With respect to claim 8-9 and 33 and the diffusion barrier, the claims have been amended to recite “wherein said diffusion barrier is configured to allow diffusion of hydrogen and prevent diffusion of intermetallic constituents.” Support for this amendment is found at least at Paragraph [0090] of the Specification:

Hydrogen permeation and purity are monitored as a function of time. Possible failure modes may include contamination of the Pd/Ag coating by intermetallic diffusion from the support that would result in decreasing hydrogen permeation (life time tests) and/or peeling-off or flaking of the coating during the thermal cycling tests. Problems arising from intermetallic diffusion can be solved by a proper choice of diffusion barrier, porous support and treatment protocols during the coating. Employing an oxide diffusion barrier provides for minimal diffusion of stainless steel constituents such as Fe and Cr into the Pd/Ag coating. [Specification, Paragraph [0090]].

As such, it is respectfully submitted the amendments to claims 8 and 33 do not add new matter and is supported by the Specification.

With respect to claim 29, the above amendments are believed to resolve any potential issues regarding the surface of the substrate and related coating and polishing.

Claims 30 and 31 are cancelled.

Objections to the Disclosure

The disclosure was objected to for informalities. Accordingly, amendments presented herewith are believed to be responsive to the objections by correcting typographical errors. No new matter is presented.

Double Patenting

Claims 29-31, 33-35, 37-38, (40-42, 45-46) & 49 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-15 of U.S. Patent No. 7,560,170 B2 (Chellappa), in view of Ma et al. (6,152,987), and optionally further in view of Hu (2001/0016236 A1), both discussed above.

Claims 1, 3-4, 8-9, (10) 11-18, 21-23, 25--31, 33-35, 37-38, (40-42, 45-46) & 49 were rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1- 27 of U.S. Patent No. 7,077,889 B2 (Chellappa et al.), in view of Ma et al. (6,152,987), and further in view of Hu (2001/0016236 A1).

The MPEP states:

Before consideration can be given to the issue of double patenting, two or more patents or applications must have at least one common inventor and/or be either commonly assigned/owned or non-commonly assigned/owned but subject to a joint research agreement as set forth in 35 U.S.C. 103(c)(2) and (3) pursuant to the CREATE Act (Pub. L. 108-453, 118 Stat. 3596 (2004)). [MPEP 804].

While multiple references may be applied in such a rejection, each and every reference must share the specified relationship with the application to be rejected. As such, it is respectfully submitted that the rejection on the ground of nonstatutory obviousness-type double patenting is improper because it relies upon references Ma et al. (6,152,987) and Hu (2001/0016236 A1). In relation to the present application, neither of these references has at least one common inventor and/or is either commonly assigned/owned or non-commonly assigned/owned but subject to a joint research agreement. For at least these reasons, it is respectfully submitted that the rejection is improper.

Otherwise, Applicant is willing to consider filing a terminal disclaimer if required to advance prosecution to allowance after all other issues are resolved.

Rejections under 35 U.S.C. §103

Claims 1, 3-4, 8-9, (10), 11- 18, 21-23, 25-31, 33-35, 37, (40-42, 45-46) & 47-49 and Claims 5-10 & 32-35 were rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. (6,152,987), in view of Hu (2001/0016236 A1), and further in view of Dye et al (6,214,090 B1) or Peachey et al.(5,738,708), optionally combined with Yoshida et al. (EP 1 208 904 A1).

References Cited Do Not Teach Or Suggest A Polishing Step

Each of independent claims 1 and 29 recited that a surface of the substrate is polished by a surface treatment “whereby the at least one surface is smoothed and whereby bulk properties of the substrate remain unchanged.”

To satisfy the limitation of “polishing”, the Office Action relies on the combination of Ma et al (6,152,987) with Dye et al (6,214,090 B1) or Peachey et al.(5,738,708). It is respectfully submitted that the combination of these references is not obvious, and further that it fails to satisfy each and every limitations of the claims.

The examiner suggests that the membranes of Dye and Peachey are analogous to the membrane of Ma. Ma teaches a membrane that is deposited on a porous metal substrate. [Ma, Abstract; Independent Claims 1 and 2].

In contrast, Dye and Peachey teach solid composite membranes that are not supported on a porous substrate. Rather, Dye discloses that “The composite multilayer membrane of the present invention is characterized as non-porous, i.e., there are no channels or passages that extend through the membrane for passage of gas molecules or the like.” [Dye, col. 3, lines 26-29; see also, Dye, Independent Claim 1; Peachey, Abstract and Independent Claim 1 (referring to the layers upon which materials are deposited as either “central metal film” or “central metal layer”)].

It is not explained in the Office Action how these different substrates are analogous or why one having ordinary skill in the art would assume that the process of Dye/Peachey being performed on a certain substrate would have an analogous effect on a substrate having opposite properties. Applicant respectfully submits that the opposite nature of the different substrates would have provided an obstacle to combination, as recognized by one having ordinary skill. [See Ma, col. 2, lines 8-15].

The examiner suggests that the central non-porous layer in Dye's composite membrane that is sandwiched between Group VIII layers is analogous to the porous substrate in Ma. The central non-porous layer of Dye and Peachey transports hydrogen as hydrogen atoms, whereas the porous metal support of Ma transports hydrogen as molecular hydrogen. It is respectfully submitted that the disclosures of at least Ma and Dye are being interpreted too broadly.

Ma discloses: "A method for fabricating a hydrogen gas-extraction membrane includes reacting the porous metal substrate with an oxidizing agent to form a ceramic intermediate layer on a surface of the porous metal substrate and covering the ceramic coating with the membrane layer that is selectively permeable to hydrogen" [Ma, Abstract, emphasis added]. Ma further discloses: "A method for forming a hydrogen gas-extraction module of this invention includes oxidizing the surface of a porous substrate with an oxidizing agent to form an intermediate ceramic coating. The intermediate coating is then covered with a membrane that is selectively permeable to hydrogen such as palladium or a palladium/silver alloy." [Ma, col. 2, lines 40-45]. In particular, the cleaning step referenced by the Examiner in Example 1 of Ma as being combinable with the processes of Dye/Peachey is followed in Ma by an oxidation step: "The cup was then oxidized with oxygen at 900° C. for 4 hours." [Ma, col. 8, lines 9-10]. Ma discloses the purpose of its oxidized intermediate layer as follows:

This invention offers the advantages, for example, of providing an intermediate layer that effectively prevents diffusion between the substrate and the membrane that is selectively permeable to hydrogen. In-situ formation of the intermediate layer in accordance with the methods of this invention also can increase the hydrogen permeability of the composite module. Further, by deriving the oxidized intermediate layer from a metallic substrate, the fracture toughness and ductility of the metallic substrate can be retained. As a result, the module can be easily mated with other metallic parts. Further still, the methods for forming the gas-separation module of this invention are economical and relatively simple to perform. [Ma, col. 2, lines 46-58].

In contrast, Dye/Peachey disclose ion milling for the purpose of removing oxidation: "In one aspect of forming the composite membrane of the present invention, the central metal film is initially cleaned to remove any surface oxidation or contamination or other surface imperfections." [Dye, col. 3, lines 30-33].

It is not provided in the Office Action why one having ordinary skill in the art would apply the process of Dye/Peachey to undermine the benefits of oxidation as disclosed in Ma. Whether the ion milling is performed before, after, or simultaneously with any cleaning step of Ma, it seems clear that the purpose and effect of the ion milling process of Dye/Peachey would render the oxidation step of Ma inoperable for its intended purpose. It is respectfully submitted that Ma and Dye/Peachey teach away from each other.

References Cited Do Not Teach Or Suggest A Step For A Direct-Write Laser

Independent claims 1 and 29 recite “a laser direct-write process” utilizing “a metallic ink having a metallic component and a carrier component, said metallic component comprising at least at least one of palladium, a palladium alloy, and a palladium and silver alloy.”

To satisfy the limitation of a “direct-write laser” step, the Office Action relies on the combination of Ma and Hu (2001/0016236 A1). It is respectfully submitted that the combination of these references is not obvious, and further that it fails to satisfy each and every limitation of the claims.

Applicants submit that even if the references could be combined (without suggesting that it is proper to do so), the combination fails to satisfy each and every limitation of the claims. Hu discloses a process utilizing metal precursors, rather than the metals. A person with ordinary skill in the art can readily appreciate that the solution containing metal precursors of Hu (suspension with metal salts) is very different from the metal-containing ink of the present claims. The materials in Hu cannot be considered a metallic ink including a “metallic component comprising at least at least one of palladium, a palladium alloy, and a palladium and silver alloy.” Further, the system and process of Hu is designed around the presumption that metal precursors are utilized, as demonstrated by the steps required to reduce the metal salts to

the resultant metals during the process thereof, making modification thereof non-obvious without some motivation to do so.

The Office Action references paragraph [0027] of Hu to support an assertion that Hu discloses a coating with a metal layer prior to reduction of metal precursors:

The Hu technique may pretreat a substrate (possibly porous metal) with a photocatalyst coating to be coated with a metal layer ([0027]), **then** with a solution containing metal precursors, for metals inclusive of Pt, Pd,... Ag,... ([0024], [0031], etc.), in carrier liquids including organic solvents or biological materials ([0024], [0030], etc.)... [Office Action, p. 9].

Hu states:

According to another embodiment of the invention, metallic film fabrication can be achieved on an ordered layer of PSI-containing units anchored or otherwise coated on the surface of a substrate (such as gold, silicon, alumina, etc.). These PSI-coated substrates have been described (see, for example, Rutherford and Stif, 1990; Lee et al., 1996; and Lee et al., 1995). The types of interactions (e.g., covalent, electrostatic, etc.) between the PSI-containing units and the substrate are not critical provided they are substantially stable in the liquid suspensions in which the photoreactions will be performed and they do not preclude the availability of the reducing end of the PSI unit for reductive metal precipitation. [Hu, paragraph [0027]].

It is not clear whether the Office Action relies upon the “PSI-containing units” or the “substrate (such as gold, silicon, alumina, etc.)” disclosed in paragraph [0027]. Each will be addressed.

The reference to PSI-containing units is indicative of reduction of a metal precursor. Hu states: “In particular, the invention takes advantage of the electron-pumping characteristics of photosynthesis system I (PSI), and other biological systems having similar features, for photocatalytically reducing metal precursor chemicals into metallic nanostructured materials.” [Hu, paragraph [0005]]. Hu further states that the PSI-containing units must not “preclude the availability of the reducing end of the PSI unit for reductive metal precipitation.” [Hu, paragraph [0027]]. Thus, the PSI-containing unit is clearly another example of reduction of a metal precursor. That a “metallic film fabrication” is the resultant product does not satisfy the

limitation of claims 1 and 29, which require “a laser direct-write process” utilizing metallic ink having a metallic component, rather than a metal precursor.

Further, the substrate (such as gold, silicon, alumina, etc.) mentioned in paragraph [0027] of Hu also fails to satisfy “a laser direct-write process.” Paragraph [0027] provides no disclosure to support any assertion that this substrate is the result of a laser direct-write process. Hu is entirely silent on the matter.

Furthermore, the Office Action appears to treat two separate processes disclosed in Hu as if they were the same process.

In Paragraphs [0006]-[0007] of Hu, cited by the Office Action, the disclosure states that the liquid suspension is partly comprised of a plurality of PSI units, metal precursors, and any other component desired for effecting photochemical reaction. The suspension is contacted with light to form PSI-metal complexes. Generally, the suspension is provided above the surface of a solid or semisolid substrate. The liquid is then removed by heat or vacuum to yield a film on the substrate that is partly comprised of the metal from the PSI-metal complexes.

This treatment as disclosed is not a direct-write laser process. As discussed above, it is a process for reducing precursors to metal, rather than transfer of a metallic ink, as claimed. Furthermore, the Office Action states that “light that may be from a position-controlable laser beam to cause reduction to metal.” The use of a laser for reduction to metal is not found in the Hu reference, but rather appears to be from the Examiner’s own knowledge and experience. It is respectfully submitted that if such a modification is to be made to Hu, it must be supported by sufficient reasoning to show how it would have been obvious to one having ordinary skill in the art without using the claims as a guide. KSR Int’l Co. v. Teleflex, Inc., 127 S.Ct. 1727, 1747 (2007). As such reasoning was not provided, it is respectfully submitted that a *prima facie* case of obviousness has not been presented.

Elsewhere in the disclosure of Hu, usage of lasers is disclosed for a separate and subsequent process step after reduction of the PSI units. In Paragraph [0034] of Hu, cited by the Office Action, the disclosure states:

In addition to the nanoparticles and continuous thin films described above, metallic patterns of nanoscale resolution may be prepared on a substrate surface by coupling laser and/or electron beam lithography techniques with the methods of this invention. For example, a position-controllable laser beam could be used to provide precise deposition of metal particles and/or lines in essentially any desired pattern on the surface of a PSI-coated substrate. [Hu, Paragraph 0034].

As disclosed, laser techniques are used only in combination with and subsequent to the reduction techniques discussed above. Hu does not specify use of a laser beam to cause reduction of metal as the examiner cites, nor does Hu disclose the use of lasers to provide any material directly to the substrate, as claimed above. Rather, Hu discloses the use of lasers as an additional step subsequent to reduction techniques. Accordingly, the laser technique provides its materials to the PSI coating, rather than to the substrate. Fabrication of metal patterns of nanoscale resolution on PSI-coated substrates is not the subject of the present claims.

As with other modifications presented in the Office Action, no reasoning is presented to support the modification of the Hu reference where Hu itself fails to satisfy the limitations of the claims above. It is respectfully submitted that a *prima facie* case of obviousness has not been presented.

The Office Action states: "The Hu technique may pretreat a substrate (possibly porous metal)." This inference appears to be made in an attempt to present Hu as readily compatible with the disclosure of Ma. However, the Examiner appears to be adding a separate specification to Hu.

Hu does not specify porous metal as a substrate upon which it may act. Hu does specify that his invention can be adapted for fabrication of various types of metal-ceramic membranes:

If the substrate on which the deposition is performed is a ceramic, the invention can be readily adapted for the fabrication of various types of metal-ceramic

membranes, e.g., (1) dense or porous metallic membranes that are supported on porous ceramic membranes; (2) metals deposited inside the pores of ceramic membranes; and (3) metals coated on solid particles that are partially sintered onto inorganic membranes. [Hu, Paragraph 0035, emphasis added].

None of these substrates includes porous metal, as represented by the Office Action. Further, no reason to modify the disclosure of Hu to include the use of porous metal substrates is provided. Accordingly, it is respectfully submitted that a *prima facie* case for obviousness has not been made because no reason to modify or combine the references has been provided.

For the above reasons, *inter alia*, reconsideration of independent claims 1 and 29 is kindly requested.

Dependent claims 3-4, 8-18, 21-23, 25-28, and 48 depend from independent claim 1. As the independent claim from which they depend is patentable, as discussed herein, claims 3-4, 8-18, 21-23, 25-28, and 48 are patentable. Reconsideration is respectfully requested.

Dependent claims 33-35, 37-38, 40-42, 45-47, and 49 depend from independent claim 29. As the independent claim from which they depend is patentable, as discussed herein, claims 33-35, 37-38, 40-42, 45-47, and 49 are patentable. Reconsideration is respectfully requested.

Claims 1, 3-4, 8-9, (10) 11-18, 21-23, 25-31, 33-35, 37-38, (40-42, 45-46) & 49 were rejected under 35 U.S.C. 103(a) as being obvious over Chellappa et al. (7,077,889 B2), in view of Ma et al. (6,152,987), and further in view of Hu (2001/0016236 A1), the combination discussed immediately above with respect to the claims.

The Office Action notes: “The applied reference has a common inventor (Anand Chellappa) with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e).” The Office Action also notes: “This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a).”

Reference is made to assignments recorded in the U.S. Patent and Trademark Office in accordance with 37 CFR Part 3 which convey the entire rights in the patents/applications to the same organization.

Assignments for Chellappa et al. (7,077,889 B2) are recorded at Reel/Frame: 013941/0466 and 016931/0356. The final assignee is Intelligent Energy, Inc. (2955 Redondo Avenue, Long Beach, California 90806).

Assignment for the present application (US Pat. Pub. No. 2007/0180991; US Pat. App. Ser. No. 10/566,334) is recorded at Reel/Frame: 018877/0361. The assignee is Intelligent Energy, Inc. (2955 Redondo Avenue, Long Beach, California 90806).

Based on the above statement concerning common ownership, Applicant submits that the subject matter of the reference (Chellappa) and the claimed invention were, at the time the claimed invention was made, owned by the same person or subject to an obligation of assignment to the same person. Accordingly, it is submitted that the reference is disqualified under 35 U.S.C. 103(c).

It is respectfully submitted that all of the Examiner's objections have been successfully addressed and that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously solicited.

A three month extension of time is submitted herewith. The Director is authorized to charge any additional fee(s) or any underpayment of fee(s), or to credit any overpayments to **Deposit Account Number 50-2298**. Please ensure that Attorney Docket Number 37929-32401 is referred to when charging any payments or credits for this case.

Respectfully submitted,

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